Final

Site Investigation Report
Former Personnel and Equipment Decontamination Station, Parcel 206(7)

Fort McClellan
Calhoun County, Alabama

Prepared for:

U.S. Army Corps of Engineers, Mobile District
109 St. Joseph Street
Mobile, Alabama 36602

Prepared by:

IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923

Task Order CK05
Contract No. DACA21-96-D-0018
IT Project No. 774645

March 2002

Revision 0

Table of Contents

Page

Table of Contents *(Continued)*

Page

List of Appendices

List of Tables

List of Figures

Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK05, IT Corporation completed a site investigation (SI) at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), at Fort McClellan in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), consisted of the sampling and analysis of three surface soil samples, two depositional soil samples, three subsurface soil samples, three surface water samples, and one sediment sample.

Chemical analyses of samples collected at the Former Personnel and Equipment Decontamination Station, indicate that metals, volatile organic compounds, and semivolatile organic compounds were detected in the various site media. To evaluate whether detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for Fort McClellan. In addition, a preliminary risk assessment (PRA) was performed to further characterize the potential threat to human health.

Although Parcel 206(7) is under control of the Alabama Army National Guard and is projected for continued use in military training operations, the SI analytical data were screened against residential human health SSSLs to evaluate the site for possible unrestricted land reuse. The PRA concluded that exposure to site media is unlikely to pose an unacceptable threat to human health in either the proposed reuse scenario or the residential (i.e., unrestricted) reuse scenario.

Four metals (antimony, barium, beryllium, and copper) in surface soils and one polynuclear aromatic hydrocarbon (PAH) compound (benzo[a]pyrene) in the sediment sample were identified as chemicals of potential ecological concern at the site. The concentrations of the metals, however, were within the same order of magnitude as their respective ESVs and/or background concentrations, except for one estimated barium result (364 mg/kg), which exceeded its ESV (165 mg/kg) and the upper background range (288 mg/kg). Barium concentrations in all other soil samples were below background. Similarly, benzo(a)pyrene was detected at an estimated concentration (0.42 mg/kg) marginally exceeding its ESV (0.33 mg/kg) in the sediment sample. Given the conservatism inherent in the ESVs and the relatively small

magnitude of the exceedances, the aforementioned metals and the PAH compound are not expected to pose a significant threat to ecological receptors.

Based on the results of the SI, past operations at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), do not appear to have adversely impacted the environment. The metals and chemical constituents detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT Corporation recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at the Former Personnel and Equipment Decontamination Station, Parcel 206(7).

1.0 Introduction

The U.S. Army has selected Fort McClellan (FTMC), located in Calhoun County, Alabama, for closure by the Base Realignment and Closure (BRAC) Commission under Public Laws 100-526 and 101-510. The 1990 Base Closure Act, Public Law 101-510, established the process by which U.S. Department of Defense (DOD) installations would be closed or realigned. The BRAC Environmental Restoration Program requires investigation and cleanup of federal properties prior to transfer to the public domain. The U.S. Army is conducting environmental studies of the impact of suspected contaminants at parcels at FTMC under the management of the U.S. Army Corps of Engineers (USACE)-Mobile District. The USACE contracted IT Corporation (IT) to perform the site investigation (SI) at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), under Contract Number DACA21-96-D-0018, Task Order CK05.

This report presents specific information and results compiled from the SI, including field sampling and analysis, conducted at the Former Personnel and Equipment Decontamination Station, Parcel 206(7).

1.1 Project Description

The Former Personnel and Equipment Decontamination Station was identified as an area to be investigated prior to property transfer. The site was classified as a Category 7 site in the environmental baseline survey (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 7 sites are areas that are not evaluated and/or that require additional evaluation.

A site-specific field sampling plan (SFSP) attachment (IT, 2001) and a site-specific safety and health plan (SSHP) attachment were finalized in March 2001. The SFSP and SSHP were prepared to provide technical guidance for sample collection and analysis at the Former Personnel and Equipment Decontamination Station, Parcel 206(7). The SFSP was used in conjunction with the SSHP as attachments to the installation-wide work plan (IT, 1998) and the installation-wide sampling and analysis plan (SAP) (IT, 2000a). The SAP includes the installation-wide safety and health plan and quality assurance plan.

The SI included fieldwork to collect three surface soil samples, two depositional soil samples, three subsurface soil samples, three surface water samples, and one sediment sample to

determine whether potential site-specific chemicals are present at the site; also, the SI provides data useful for supporting any future corrective measures and closure activities.

1.2 Purpose and Objectives

The SI program was designed to collect data from site media and provide a level of defensible data and information in sufficient detail to determine whether chemical constituents are present at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), at concentrations that present an unacceptable risk to human health or the environment. The conclusions of the SI in Chapter 6.0 are based on the comparison of the analytical results to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. The SSSLs and ESVs were developed by IT as part of the human health and ecological risk evaluations associated with SIs being performed under the BRAC Environmental Restoration Program at FTMC. The SSSLs, ESVs, and polynuclear aromatic hydrocarbon (PAH) background screening values are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000b). The PAH background screening values were developed by IT at the direction of the BRAC Cleanup Team to address the occurrence of PAH compounds in surface soils as a result of anthropogenic activities at FTMC. Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998).

Based on the conclusions presented in this SI report, the BRAC Cleanup Team will decide either to propose "No Further Action" at the site or to conduct additional work at the site.

1.3 Site Description and History

The Former Personnel and Equipment Decontamination Station, Parcel 206(7), is located in the north-central portion of Pelham Range (Figure 1-1). The site was reportedly used during the 1950s and 1960s as a decontamination area for outer garments and equipment potentially contaminated by mustard, distilled mustard, and lewisite. The equipment and outer garments were decontaminated using supertropical bleach (STB), decontamination agent (noncorrosive) (DANC), and/or decontamination solution number two (DS2) (ESE, 1998).

An individual interviewed during the EBS reported that the Former Personnel and Equipment Decontamination Station was a secondary decontamination station and stated that only soap and water were used at this site. The individual also reported that outer garments and equipment were decontaminated at an area near Rideout Hall prior to moving personnel and equipment to

the Former Personnel and Equipment Decontamination Station. The interview notes do not provide information indicating the use of STB, DANC, and/or DS2 at this site. During the interview, the only chemical agent referred to in conjunction with this site was lewisite (U.S. Army Center for Health Promotion and Preventative Medicine [CHPPM], 1999).

Parcel 206(7) is approximately 3 acres in size (Figure 1-2). There are no fences limiting access to the site. A small (approximately one-half acre), unnamed pond is located in the northern portion of the parcel. Smoke pots were floated on the pond during training exercises; also, some unburned smoke pots were reportedly disposed of in the pond (CHPPM, 1999). Due to the potential unauthorized disposal of materials into the pond and the floating smoke pots on the pond for training purposes, the pond was included in the parcel during the EBS (ESE, 1998).

2.0 Previous Investigations

An EBS was conducted by ESE to document current environmental conditions of all FTMC property (ESE, 1998). The study was to identify sites that, based on available information, have no history of contamination and comply with DOD guidance for fast-track cleanup at closing installations. The EBS also provides a baseline picture of FTMC properties by identifying and categorizing the properties by seven criteria:

1. Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas)

2. Areas where only release or disposal of petroleum products has occurred

3. Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial response

4. Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions to protect human health and the environment have been taken

5. Areas where release, disposal, and/or migration of hazardous substances has occurred, and removal or remedial actions are underway, but all required remedial actions have not yet been taken

6. Areas where release, disposal, and/or migration of hazardous substances has occurred, but required actions have not yet been implemented

7. Areas that are not evaluated or require additional evaluation.

The EBS was conducted in accordance with the Community Environmental Response Facilitation Act (CERFA) (CERFA-Public Law 102-426) protocols and DOD policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, the Alabama Department of Environmental Management (ADEM), the U.S. Environmental Protection Agency (EPA) Region IV, and Calhoun County, as well as a database search of Comprehensive Environmental Response, Compensation, and Liability Act-regulated substances, petroleum products, and Resource Conservation and Recovery Act-regulated facilities. Available historic maps and aerial photographs were reviewed to document historic land uses. Personal and telephone interviews of past and present FTMC

employees and military personnel were conducted. In addition, visual site inspections were conducted to verify conditions of specific property parcels.

The Former Personnel and Equipment Decontamination Station, Parcel 206(7), was identified as a CERFA Category 7 site. CERFA Category 7 sites are areas that lack adequate documentation and, therefore, require additional evaluation to determine the environmental condition of the parcel.

3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by IT at the Former Personnel and Decontamination Station, Parcel 206(7), including unexploded ordnance (UXO) avoidance and environmental sampling and analysis activities.

3.1 Unexploded Ordnance Avoidance

UXO avoidance was performed at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), following methodology outlined in Section 4.1.7 of the SAP (IT, 2000a). IT UXO personnel used a low-sensitivity magnetometer to perform a surface sweep of the parcel prior to site access. After the parcel was cleared for access, sample locations were monitored following procedures outlined in Section 4.1.7.3 of the SAP (IT, 2000a). Additional UXO procedures for anomaly avoidance during the collection of surface water and sediment samples from the pond at Parcel 206(7) are provided in the site-specific field sampling plan and the site-specific UXO safety plan (IT, 2001).

3.2 Environmental Sampling

The environmental sampling performed during the SI at the Former Personnel and Decontamination Station, Parcel 206(7), included the collection of surface and depositional soil samples, subsurface soil samples, and surface water and sediment samples for chemical and physical analysis. The sample locations were determined by observing site physical characteristics during a site walkover and by reviewing historical documents pertaining to activities conducted at the site. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.4.

3.2.1 Surface and Depositional Soil Sampling

Three surface soil samples and two depositional soil samples were collected at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Sample designations and analytical parameters are listed in Table 3-2. Soil sampling locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

Sample Collection. Surface and depositional soil samples were collected from the upper 1 foot of soil using either a direct-push technology (DPT) sampler or a stainless-steel hand auger following methodology specified in Section 4.9.1.1 of the SAP (IT, 2000a). Surface and depositional soil samples were collected by first removing surface debris (e.g., rocks, vegetation) from the immediate sample area. The soil was then collected with the sampling device and screened with a photoionization detector (PID) in accordance with Section 4.7.1.1 of the SAP (IT, 2000a). Samples for volatile organic compound (VOC) analysis were collected directly from the sampler using three EnCore® samplers. The remaining portion of the sample was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

3.2.2 Subsurface Soil Sampling

Subsurface soil samples were collected from three soil borings at the Former Personnel and Equipment Decontamination Station, Parcel 206(7). Subsurface soil sampling locations and rationale are presented in Table 3-1. Subsurface soil sample designations, depths, and analytical parameters are listed in Table 3-2. Soil boring sampling locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography. IT contracted Environmental Services Network, a DPT subcontractor, to assist in subsurface soil sample collection.

Sample Collection. Subsurface soil samples were collected from soil borings at depths greater than 1 foot below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and soil samples collected using the DPT sampling procedures specified in Section 4.9.1.1 of the SAP (IT, 2000a). Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

Subsurface soil samples were collected continuously to 12 feet bgs or until DPT sampler refusal was encountered. Samples were field-screened using a PID in accordance with Section 4.7.1.1 of the SAP (IT, 2000a) to measure for volatile organic vapors. The soil sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were not greater than background, the deepest soil sample interval above the saturated zone was submitted for analysis. Samples for VOC analysis were collected directly from the sampler using three EnCore® samplers. The remaining portion of the sample was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample

containers. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4. The on-site geologist constructed a detailed boring log for each soil boring. The lithological log for each borehole is included in Appendix B.

At the completion of soil sampling, boreholes were abandoned with bentonite pellets and hydrated with potable water following borehole abandonment procedures summarized in Appendix B of the SAP (IT, 2000a).

3.2.3 Surface Water Sampling

Three surface water samples were collected from the pond at the Former Personnel and Decontamination Station, Parcel 206(7), as shown on Figure 3-1. The surface water sampling locations and rationale are listed in Table 3-1. Surface water sample designations and analytical parameters are listed in Table 3-3. The actual sampling locations were determined in the field based on actual field observations.

Sample Collection. Surface water samples were collected in accordance with the procedures specified in Section 4.9.1.3 of the SAP (IT, 2000a). Three surface water samples were collected from one location (HR-206-SW/SD03) in the middle of the pond. Each of the surface water samples at HR-206-SW/SD03 was collected from a discrete interval within the water column and analyzed separately.

Prior to sample collection, surface water field parameters (pH, temperature, dissolved oxygen, oxidation-reduction potential, specific conductivity, and turbidity) were measured from the water column from top to bottom in order to determine the presence of stratification or a thermocline. Surface water field parameters are listed in Table 3-4. The three sample intervals for the surface water samples collected at location HR-206-SW/SD03, were the top of the water column, middle of the water column, and the bottom of the water column. These three sample depths were approximately 0 to 1.0 foot, 2.0 to 3,0 feet, and 3.0 to 3.8 feet, respectively. The deepest surface water sample was carefully collected to avoid disturbing the sediment.

Sampling personnel used a flat-bottom boat to reach the sample location in the middle of the pond. A discrete subsurface water sampler was used to collect the surface water samples. This sampling device consisted of a sealed glass bottle attached to a metal tubing handle that was submerged to the required sample depth to collect the sample. The sample for the VOC analysis was collected first from each sample interval. The sample bottle was cleaned between each sample collection for each sample interval. Sample collection logs are included in Appendix A.

The samples were analyzed for the parameters listed in Table 3-3 using methods outlined in Section 3.4.

3.2.4 Sediment Sampling

One sediment sample was collected at the same location as the surface water samples, as shown on Figure 3-1. The sediment sampling location and rationale are presented in Table 3-1. The sediment sample designation and analytical parameters are listed in Table 3-3.

Sample Collection. The sediment sample was collected after the surface water samples to minimize the possibility of introducing sediments into the surface water samples. Collection of the sediment sample began by lowering a piece of polyvinyl chloride (PVC) pipe until it contacted the bottom of the pond. IT UXO personnel then lowered a magnetometer into the pipe until it reached the sediment at the bottom of the pond. When no anomalies were detected, the probe was withdrawn and sediment sampling began. The sediment sample was collected with a hand auger through the PVC pipe. Once a sufficient quantity of sediment was collected, the pipe was removed from the pond. The sediment sample fraction for VOC analysis was collected using three EnCore samplers. The remaining portion of the sample was homogenized and placed in the appropriate sample containers. Sample documentation and chain-of-custody records were recorded as specified in Section 4.4 of the SAP. The sediment sample was analyzed for the parameters listed in Section 3.4 of this SI report.

3.3 Surveying of Sample Locations

Sample locations were surveyed using global positioning system survey techniques described in Section 4.3 of the SAP, and conventional civil survey techniques described in Section 4.19 of the SAP (IT, 2000a). Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix C.

3.4 Analytical Program

Samples collected during the SI were analyzed for various chemical and physical parameters based on the potential site-specific chemicals and on EPA, ADEM, FTMC, and USACE requirements. Samples collected at the Former Personnel and Decontamination Station, Parcel 206(7), were analyzed for the following parameters:

- Target compound list VOCs – EPA Method 5035/8260B
- Target compound list semivolatile organic compounds (SVOC) – EPA Method 8270C
- Target analyte list metals – EPA Method 6010B/7000
- Nitroaromatic and nitramine explosives – EPA Method 8330
- CWM breakdown products (including other sulfur compounds) – EPA Methods 8270/8321.

The depositional soil samples and the sediment sample were analyzed for the following additional parameters:

- Total organic carbon (TOC) – EPA Method 9060
- Grain size – American Society for Testing and Materials Method D421/D422.

The samples were analyzed using EPA SW-846 methods, including Update III methods where applicable, as presented in Table 6-1 in Appendix B of the SAP (IT, 2000a).

3.5 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in Section 4.13.2 of the SAP (IT, 2000a). Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SI are listed in Table 5-1 of Appendix B of the SAP (IT, 2000a). Sample documentation and chain-of-custody records were completed as specified in Section 4.13 of the SAP (IT, 2000a).

Completed analysis request and chain-of-custody records (Appendix A) were secured and included with each shipment of sample coolers to EMAX Laboratories, Inc. in Torrance, California.

3.6 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in Appendix D of the SAP (IT, 2000a). The IDW generated during the SI at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), was segregated as follows:

- Soil boring cuttings
- Decontamination fluids
- Personal protective equipment.

Solid IDW was stored on site in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analysis. Based on the results, soil boring cuttings and personal protective equipment generated during the SI were disposed as nonregulated waste at the Industrial Waste Landfill on the Main Post of FTMC.

Liquid IDW was contained in a portable frac tank at the site pending waste characterization. Liquid IDW was characterized by VOC, SVOC, and metals analyses. Based on the analyses, liquid IDW was discharged as nonregulated waste.

3.7 Variances/Nonconformances

One variance to the SFSP was recorded during completion of the SI at the Former Personnel and Equipment Decontamination Station, Parcel 206(7). The variance did not alter the intent of the investigation or the sampling rationale presented in the SFSP (IT, 2001). The variance to the SFSP is summarized in Table 3-5 and included in Appendix D.

No nonconformances to the SFSP were recorded during completion of the SI.

3.8 Data Quality

The field sampling analytical data are presented in tabular form in Appendix E. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the SI work plan; the FTMC SAP and quality assurance plan; and standard, accepted methods and procedures. Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 1994) and the stipulated requirements for the generation of definitive data (Section 3.1.2 of Appendix B of the SAP [IT, 2000a]). Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms.

Data Validation. The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. The data validation results are summarized in a quality assurance report, which includes the data validation summary report (Appendix F). Selected results were rejected or otherwise qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the

report. The validation-assigned qualifiers were added to the FTMC IT Environmental Management System™ database for tracking and reporting. The qualified data were used in the comparison to the SSSLs and ESVs. Rejected data (assigned an "R" qualifier) were not used in the comparison to the SSSLs and ESVs.

The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

4.0 Site Characterization

Subsurface investigations performed at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), provided soil and geologic data used to characterize the geology of the site. Because no groundwater monitoring wells were installed at the site, a hydrogeological characterization was not performed.

4.1 Regional and Site Geology

4.1.1 Regional Geology

Calhoun County includes parts of two physiographic provinces, the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county, and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including the Main Post of FTMC, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold and thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted, with major structures and faults striking in a northeast-southwest direction.

Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults, and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992), and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group consists of the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984) but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper undifferentiated Wilson Ridge

and Weisner Formation. The Cochran is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish-gray siltstone and mudstone. Massive to laminated greenish-gray and black mudstone makes up the Nichols Formation, with thin interbeds of siltstone and very fine-grained sandstone (Szabo et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appear to dominate the unit and consist primarily of coarse-grained, vitreous quartzite, and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consist of sandy and micaceous shale and silty, micaceous mudstone, which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east and southwest of the Main Post and consists of interlayered bluish-gray or pale yellowish-gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on FTMC (Osborne and Szabo, 1984). The character of the Shady Dolomite in the FTMC vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of the Main Post as mapped by Warman and Causey (1962), and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish-red-purple mudstone, shale, siltstone, and greenish-red and light gray sandstone, with locally occurring limestone and dolomite. The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of the Main Post (Osborne et al., 1997). The Conasauga Formation is composed of dark-gray, finely to coarsely crystalline medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone is comprised of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped as undifferentiated at FTMC and other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at FTMC and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites and limestones, and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish-gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomudstone, and glauconitic limestone (Szabo et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish-gray to grayish-red phosphatic shale, with increasing amounts of calcareous chert toward the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian age, which consists of thin-bedded, fissile brown to black shale with thin intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned

the Floyd Shale, which was mapped by Warman and Causey (1962) on the Main Post of FTMC, to the Ordovician Athens Shale based on fossil data.

The Pennsylvanian Parkwood Formation overlies the Floyd Shale and consists of a medium to dark-gray, silty, clay shale and mudstone with interbedded light to medium gray very fine to fine grained argillaceous, micaceous sandstone. Locally the Parkwood Formation also contains beds of medium- to dark-gray argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et. al., 1988). The Parkwood Formation in Calhoun County is generally found within a structurally complex area known as the Coosa ceformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovzal, 1974; Osborne et. al, 1988). The undifferentiated Pennsylvanian Parkwood Formation and Mississippian Floyd Shale are found throughout the western quarter of Pelham Range.

The Jacksonville thrust fault is the most significant structural geologic feature in the vicinity of the Main Post of FTMC, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo, 1984). The Ordovician sequence that makes up the Eden thrust sheet is exposed at FTMC through an eroded window, or fenster, in the overlying thrust sheet. Rocks within the window display complex folding with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The FTMC window is framed on the northwest by the Rome Formation, north by the Conasauga Formation, northeast, east, and southwest by the Shady Dolomite, and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the FTMC window (Osborne et. al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the FTMC window and the Rome and Conasauga Formations. The trace of the Pell City fault is also exposed approximately nine miles west of the FTMC window on Pelham Range where it traverses northeast to southwest across the western quarter of Pelham Range. Here, the trace of the Pell City Fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three quarters of Pelham Range is located within the Pell City thrust sheet while the remaining western quarter of Pelham is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks and is relatively less structurally complex than the Coosa Deformed Belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the FTMC window, and along the trace of the Pell City fault on Pelham Range (Thomas and Neathery, 1982 and Szabo et. al., 1988). The Coosa deformed belt is a narrow (approximately 5 to 20 miles wide) northeast- to-southwest-trending linear (approximately 90 miles in length) zone of complex structure consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

4.1.2 Site Geology

Soils found within the area of investigation for this SI are the Rarden gravelly, loam and the Tyler silt, loam. The Rarden gravelly loam underlies a majority of the area of investigation, with only the southwest corner of the parcel underlain by the Tyler silt, loam (U.S. Department of Agriculture [USDA], 1961).

The Rarden silt loam is a moderately drained, strongly acid soil, which has developed from the residuum of shale and fine-grained sandstone or limestone. The color of this soil ranges from brown to dark brown to yellowish brown. The subsoil consists of yellowish-red mottled strong brown, clay or silt clay. Fragments of sandstone up to one-half inch in diameter are commonly found throughout the soil. Runoff and infiltration of this soil are medium, permeability and drainage are slow, the available moisture and organic matter are low (USDA, 1961).

The Tyler silt loam is a strongly acidic, poorly drained soil formed on low stream terraces that has developed in alluvium washed from soils derived primarily from sandstone, shale and to a lesser extent limestone. The color of this soil is grayish brown. The subsoil is a mottled, light yellowish-brown, fine, sandy, clay, loam. Runoff and permeability of this soil are slow, infiltration is medium, the available moisture and organic matter are low (USDA, 1961).

The bedrock at the site is mapped as a combination of the Pennsylvanian Parkwood and Mississippian Floyd Shale Undifferentiated, and the Cambrian/Ordovician Knox Group. The majority of the site is underlain by the Undifferentiated Parkwood Formation and Floyd Shale with only the extreme eastern portion of the parcel underlain by the Knox Group. The contact between the Undifferentiated Parkwood Formation and Floyd Shale with the Knox Group

represents the thrust fault contact of the Pell City Fault, a major thrust fault located along the eastern boundary of the parcel (Figure 4-1) (Thomas and Drahovzal, 1974; Osborne et. al., 1988).

The Pennsylvanian Parkwood Formation consists of medium- to dark-gray, silty shale and mudstone with interbedded light to medium gray, very fine to fine grained argillaceous, micaceous sandstone (Raymond et. al., 1988). The Floyd Shale consists of thin-bedded, fissile brown to black shale with thin intercalated limestone layers and interbedded sandstone. The Knox Group consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984).

The soil encountered during DPT activities at Parcel 206(7) ranged from a yellowish-orange to reddish-brown gravelly, sandy, clay from the surface to a total depth of between 4 to 6 feet bgs. Below 4 to 6 feet bgs the soil consisted of a brown sandy, silty, clay. The soil descriptions from the DPT borings are consistent with the characteristics of the mapped Rarden gravelly, loam and the Tyler silt, loam. Bedrock and groundwater were not encountered during DPT activities.

4.2 Surface Hydrology

Precipitation in the form of rainfall averages about 54 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface-water feature at Pelham Range is Cane Creek; the creek and its associated tributaries drain most of Pelham Range. Cane Creek flows east to west across the range and empties into the Coosa River located just west of Pelham Range. Other surface water features at Pelham Range include Lake Contreras, Willet Springs, and the Blue Hole (SAIC, 2000).

The elevation of the Former Personnel and Equipment Decontamination Station, Parcel 206(7), is approximately 575 feet above mean sea level. A small, unnamed pond is located in the northern portion of the parcel. The pond is approximately a half-acre in size and is about five feet deep. The pond collects surface runoff from the northeastern portion of the parcel and areas located east of the site. The pond empties into an intermittent stream located along the northern boundary of the parcel and flows west into an unnamed tributary of Cane Creek located approximately 500 feet east of the site. The western and southern portion of the parcel gently slopes to the west. Surface run off from this portion of the parcel most likely collects in the unnamed tributary of Cane Creek located west of the Parcel 206(7).

5.0 Summary of Analytical Results

The results of the chemical analyses of samples collected at the Former Personnel and Decontamination Station, Parcel 206(7), indicate that metals and VOCs were detected in the various site media. In addition, one SVOC was detected in the sediment sample. Neither explosives nor CWM breakdown products were detected in site media. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC.

Metals concentrations exceeding the SSSLs and ESVs were subsequently compared to metals background screening values to determine if the metals concentrations are within natural background concentrations (SAIC, 1998) . Summary statistics for background metals samples collected at FTMC are included in Appendix G.

Six compounds were quantified by both SW-846 Method 8260B (as VOC) and Method 8270C (as SVOC), including 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichlorobenzene, hexachlorobutadiene, and naphthalene. Method 8260B yields a reporting limit (RL) of 0.005 milligrams per kilogram (mg/kg), while Method 8270C has an RL of 0.330 mg/kg, which is typical for a soil matrix sample. Because of the direct nature of the Method 8260B analysis and its resulting lower RL, this method should be considered superior to Method 8270C when quantifying low levels (0.005 to 0.330 mg/kg) of these compounds. Method 8270C and its associated methylene chloride extraction step is superior, however, when dealing with samples that contain higher concentrations (greater than 0.330 mg/kg) of these compounds. Therefore, all data were considered and none were categorically excluded. Data validation qualifiers were helpful in evaluating the usability of data, especially if calibration, blank contamination, precision, or accuracy indicator anomalies were encountered. The validation qualifiers and concentrations reported (e.g., whether concentrations were less than or greater than 0.330 mg/kg) were used to determine which analytical method was likely to return the more accurate result.

The following sections and Tables 5-1 through 5-4 summarize the results of the comparison of detected constituents to the SSSLs, ESVs, and background screening values. Complete analytical results are presented in Appendix E.

5.1 Surface and Depositional Soil Analytical Results

Three surface soil samples and two depositional soil samples were collected for chemical analyses at the Former Personnel and Equipment Decontamination Station, Parcel 206(7). Surface and depositional soil samples were collected from the upper 1 foot of soil at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs, ESVs, and metals background screening values, as presented in Table 5-1.

Metals. Twenty-one metals were detected in surface and depositional soil samples collected at the site. The concentrations of five metals (aluminum, antimony, arsenic, chromium, and iron) exceeded SSSLs. Of these metals, aluminum (HR-206-GP01 and HR-206-GP02), antimony (HR-206-GP01), and iron (HR-206-GP02 and HR-206-GP03) concentrations also exceeded their respective background concentration. With the exception of the antimony result, the concentrations of these metals were within the range of background values determined by SAIC (1998) (Appendix G). The antimony concentration (4.89 mg/kg) exceeded the SSSL (3.11 mg/kg) and upper background range (2.6 mg/kg).

Ten metals were detected at concentrations exceeding ESVs. However, only eight metals were detected at concentrations exceeding ESVs and their respective background concentration: aluminum, antimony, barium, beryllium, chromium, copper, iron, and zinc. With the exception of antimony (HR-206-GP01), barium (HR-206-GP01), beryllium (HR-206-GP01 and HR-206-GP02), and copper (HR-206-GP01 and HR-206-GP02), the concentrations of these metals were within the range of background values determined by SAIC (1998).

Volatile Organic Compounds. Five VOCs (2-butanone, acetone, ethylbenzene, methylene chloride, and p-cymene) were detected in surface and depositional soil samples collected at the Former Personnel and Equipment Decontamination Station, Parcel 206(7). The methylene chloride results were flagged with a "B" data qualifier, signifying that this compound was also detected in an associated laboratory or field blank sample. All of the remaining results, except ethylbenzene at HR-206-GP01, were flagged with a "J" data qualifier indicating that the compounds were positively identified but the concentrations were estimated. The VOC concentrations in the surface and depositional soil samples ranged from 0.0013 mg/kg to 0.150 mg/kg and were below SSSLs and ESVs.

5.2 Subsurface Soil Analytical Results

Three subsurface soil samples were collected for chemical analyses at the Former Personnel and Equipment Decontamination Station, Parcel 206(7). Subsurface soil samples were collected at depths greater than 1 foot bgs at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background concentrations, as presented in Table 5-2.

Metals. Eighteen metals were detected in subsurface soil samples collected at the site. The concentrations of four metals (aluminum, arsenic, chromium, and iron) exceeded SSSLs. With the exception of aluminum in all three samples, the metals concentrations were below their respective background concentration. However, the aluminum results were within the range of background values determined by SAIC (1998) (Appendix G).

Volatile Organic Compounds. Two VOCs (acetone and methylene chloride) were detected in subsurface soil samples collected at the site. Methylene chloride was detected in all three subsurface soil samples; however, the results were flagged with a "B" data qualifier, signifying that this compound was also detected in an associated laboratory or field blank sample. The single acetone result was flagged with a "J" data qualifier, indicating that the compound was positively identified but the concentration was estimated. The VOC concentrations in subsurface soils were below SSSLs.

5.3 Surface Water Analytical Results

Three surface water samples were collected for chemical analyses at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), at the location shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 5-3.

Metals. Twelve metals were detected in surface water samples collected at the Former Personnel and Decontamination Station, Parcel 206(7). The concentrations of two metals (arsenic and iron) exceeded SSSLs. Only arsenic in the shallow and deep sample intervals (0 to 1.0 feet and 3.0 to 3.8 feet) also exceeded its respective background concentration. However, the arsenic results were within the range of background values determined by SAIC (1998) (Appendix G).

Five metals (aluminum, barium, iron, lead, and manganese) were detected in the surface water samples at concentrations exceeding ESVs. However, all of these results were below the background values determined by SAIC (1998) (Appendix G).

Volatile Organic Compounds. Four VOCs, including acetone, terachloroethene, trichloroethene, and cis-1,2-dichloroethene, were detected in surface water samples collected at the site. Acetone was only detected in the deep surface water sample and the result was flagged with a "B" data qualifier, signifying that this compound was also detected in an associated laboratory or field blank sample. Tetrachloroethene, trichloroethene, and cis-1,2-dichloroethene were detected in all three samples. VOC concentrations in the surface water samples ranged from 0.00045 milligrams per liter to 0.0045 milligrams per liter and were below SSSLs and ESVs.

5.4 Sediment Analytical Results

One sediment sample was collected for chemical and physical analyses at the Former Personnel and Equipment Decontamination Station, Parcel 206(7). The sediment sample was collected from the bottom of the pond, as shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 5-4.

Metals. Eighteen metals were detected in the sediment sample collected at the site. The beryllium, silver, and sodium results were flagged with a "B" data qualifier, signifying that these metals were also detected in an associated laboratory or field blank sample.

The metals concentrations in the sediment samples were below SSSLs. Only the copper result exceeded its ESV and respective background concentration. However, the copper result was within the range of background values determined by SAIC (1998) (Appendix G).

Volatile Organic Compounds. Five VOCs, including 2-butanone, acetone, benzene, carbon disulfide, and methylene chloride, were detected in the sediment sample collected at the site. All of the VOC results were flagged with a "J" data qualifier, indicating that the compounds were positively identified but the concentrations were estimated.

All VOC concentrations in the sediment sample were below SSSLs and ESVs.

Semivolatile Organic Compounds. Benzo(a)pyrene, a PAH compound, was the only detected SVOC in the sediment sample. The benzo(a)pyrene result was flagged with a "J" data qualifier, indicating that the compound was positively identified but the concentration was estimated. The concentration of benzo(a)pyrene in the sediment sample (0.420 mg/kg) was below its SSSL; however, the result minimally exceeded its ESV (0.330 mg/kg).

Total Organic Carbon. The sediment sample was analyzed for TOC content. The TOC concentration in the sediment sample was 141 mg/kg, as summarized in Appendix F.

Grain Size. The results of grain size analysis for the sediment sample are included in Appendix F.

5.5 Preliminary Risk Assessment

A preliminary risk assessment (PRA) was performed to further characterize the potential threat to human health from exposure to environmental media at the Former Personnel and Equipment Decontamination Station, Parcel 206(7). The PRA approach was developed at the request of EPA and ADEM to provide a fast and inexpensive estimation of risk for relatively simple sites. It was derived from the streamlined risk assessment (SRA) protocol developed for FTMC and documented in the installation-wide work plan (IT, 1998). A PRA is a simplified version of a SRA, differing primarily in that the maximum detected concentration (MDC) rather than an estimate of average is adopted as the source-term concentration (STC) for use in the risk assessment. Documentation is not provided herein to save space and time. However, a PRA cannot be less conservative (protective) than a SRA and is generally more protective. The PRA for Parcel 206(7) is included as Appendix H. It discusses the environmental media of interest, selection of site-related chemicals, selection of chemicals of potential concern (COPC), risk characterization, and conclusions.

The foundation of the SRA (and the PRA) is the SSSL, which incorporates all the exposure and toxicological assumptions and precision of a full-blown baseline risk assessment. SSSLs are receptor-, medium- and chemical-specific risk-based concentrations that are used to screen media to select COPCs and to characterize the risk, i.e., compute the incremental lifetime cancer risk (ILCR) and hazard index (HI) for noncancer effects associated with exposure to the media at the site.

The SSSLs applied to a given site represent the most highly exposed receptor scenario for each of several plausible uses for the site. Both the residential and National Guardsperson receptor

scenarios were evaluated for Parcel 206(7). COPCs were selected from the site-related chemicals identified in the previous sections by comparing the MDC of the site-related chemical with the appropriate SSSL. Chemicals that were identified as not being site-related were dropped from further consideration because their presence was not attributed to site activities. The COPCs selected in this manner are the chemicals in each medium that may contribute significantly to cancer risk or to the potential for noncancer effects. As noted above, the MDC was selected as the STC for use in risk characterization. ILCR and HI values were estimated for each COPC in each medium and were summed to obtain total ILCR and HI values for each receptor.

The PRA concluded that exposure to site media is unlikely to result in unacceptable cancer risk or adverse noncancer health effects in either the national guardsperson or residential reuse scenarios.

6.0 Summary, Conclusions, and Recommendations

IT, under contract with USACE, completed an SI at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site at concentrations that present an unacceptable risk to human health or the environment. The SI consisted of the sampling and analysis of three surface soil samples, two depositional soil samples, three subsurface soil samples, three surface water samples, and one sediment sample.

Chemical analysis of samples collected at the Former Personnel and Decontamination Station, Parcel 206(7), indicates that metals and VOCs were detected in the various site media. In addition, one SVOC was detected in the sediment sample. Explosives and CWM breakdown products were not detected in site media. Analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC. Additionally, metals concentrations exceeding SSSLs and ESVs were compared to media-specific background screening values (SAIC, 1998). A PRA was also performed to further characterize the potential threat to human health.

Although the Former Personnel and Equipment Decontamination Station, Parcel 206(7), is under control of the Alabama Army National Guard and is projected for continued use in military operations, the SI analytical data were screened against residential human health SSSLs to evaluate the site for possible unrestricted land reuse. Based on the results of the SI, the site can be released for unrestricted use requiring no further action.

Four metals (antimony, barium, beryllium, and copper) in surface soils and one PAH compound (benzo[a]pyrene) in the sediment sample were identified as chemicals of potential ecological concern at the site. The metals exceedances, however, were within the same order of magnitude as their respective ESVs and/or background concentrations, and were marginal exceedances except for one "J"-flagged (estimated) barium result (364 mg/kg), which exceeded the ESV (165 mg/kg) and the upper background range (288 mg/kg). Barium concentration in all other soil samples were below background. Similarly, benzo(a)pyrene was detected at an estimated concentration (0.42 mg/kg) marginally exceeding its ESV in the sediment sample. Given the conservatism inherent in the ESVs and the relatively small magnitude of the exceedances, the

aforementioned metals and PAH compound are not expected to pose a significant threat to ecological receptors.

Based on the results of the SI, past operations at the Former Personnel and Equipment Decontamination Station, Parcel 206(7), do not appear to have adversely impacted the environment. The metals and chemical constituents detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT Corporation recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at the Former Personnel and Decontamination Station, Parcel 206(7).

7.0 References

Cloud, P. E., Jr., 1966, ***Bauxite Deposits of the Anniston, Fort Payne, and Asheville Areas, Northeast Alabama***, U. S. Geological Survey Bulletin 1199-O, 35p.

Environmental Science and Engineering, Inc. (ESE), 1998, ***Final Environmental Baseline Survey, Fort McClellan, Alabama***, prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland, January.

IT Corporation (IT), 2001, ***Final Site-Specific Field Sampling Plan Attachment for the Former Personnel and Equipment Decontamination Station, Parcel 206(7), Fort McClellan, Calhoun County, Alabama***, March.

IT Corporation (IT), 2000a, ***Final Installation-Wide Sampling and Analysis Plan, Fort McClellan, Calhoun County, Alabama***, March.

IT Corporation (IT), 2000b, ***Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama***, July.

IT Corporation (IT), 1998, ***Final Installation-Wide Work Plan, Fort McClellan, Calhoun County, Alabama***, August.

Moser, P. H., and DeJarnette, S. S., 1992, ***Ground-water Availability in Calhoun County, Alabama***, Geological Survey of Alabama Special Map 228.

Osborne, W. E., 1999, Personal communication with John Hofer, IT Corporation.

Osborne, W. E., and Szabo, M. W., 1984, ***Stratigraphy and Structure of the Jacksonville Fault, Calhoun County, Alabama***, Geological Survey of Alabama Circular 117.

Osborne, W. E., Irving, G. D., and Ward, W. E., 1997, ***Geologic Map of the Anniston 7.5' Quadrangle, Calhoun County, Alabama***, Geological Survey of Alabama Preliminary Map, 1 sheet.

Osborne, W. E., Szabo, M. W., Copeland, C. W. Jr., and Neathery, T. L., 1989, ***Geologic Map of Alabama***, Geological Survey of Alabama Special Map 221, scale 1:500,000, 1 sheet.

Raymond, D. E., Osborne, W. E., Copeland, C. W., and Neathery, T. L., 1988, ***Alabama Stratigraphy***, Geological Survey of Alabama, Tuscaloosa, Alabama, 97 p.

Science Applications International Corporation (SAIC), 1998, ***Final Background Metals Survey Report, Fort McClellan, Alabama.***

Szabo, M. W., Osborne, W. E., Copeland, C. W., Jr., and Neathery, T. L., compilers, 1988, ***Geologic Map of Alabama***, Geological Survey of Alabama Special Map 220, scale 1:250,000, 5 sheets.

Thomas, W. A., and Neathery, T. L., 1982, ***Appalachian Thrust Belts in Alabama: Tectonics and Sedimentation***, Geologic Society of America 1982 Annual Meeting, New Orleans, Louisiana, Field Trip, Alabama Geological Society Guidebook 19A, 78 p.

Thomas, W. A., and Drahovzal, J. A., 1974, ***The Coosa Deformed Belt in the Alabama Appalachians***, Alabama Geological Society, 12th Annual Field Trip Guidebook 98 p.

U.S. Army Center for Health Promotion and Preventative Medicine (CHPPM), 1999, ***Draft Preliminary Assessment No. 38-EH-1775-99, Fort McClellan Army National Guard Training Center, Fort McClellan, Alabama,*** June.

U.S. Army Corps of Engineers, 1994, ***Requirements for the Preparation of Sampling and Analysis Plans***, Engineer Manual EM 200-1-3, September.

U.S. Department of Agriculture, 1961, ***Soil Survey, Calhoun County, Alabama***, Soil Conservation Service, Series 1958, No. 9, September.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1998, Unedited Local Climatological Data, Anniston, Alabama, January - December 1998.

Warman, J. C, and Causey, L. V., 1962, ***Geology and Ground-water Resources of Calhoun County, Alabama,*** Geological Survey of Alabama County Report 7, 77 p.